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AUTHOR Schrautemeier, Bernard E.
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ABSTRACT

The problems of the comprehensive community college as a complex institution offering physics courses in the traditional subject matter areas, as well as in the less familiar areas of technical and occupational education, remedial education, and adult education are summarized along with some suggested solutions. Among the general issues are the necessity: (1) to teach courses in fields other than physics, (2) to teach several different levels of physics courses, (3) to deal with increasing numbers of students with average or deprived educational and social backgrounds, (4) to remake the image of physics, (5) to reformulate the basic goals of physics education and to try to order such goals in some sort of priority listing, (6) to adequately respond to the growing demands of the accountability movement, (7) to dedicate a designated percentage of institutional budgets to educational research and improvement, (8) to improve communication between high school, 4-year college, university and community college instructors, (9) to maintain good rapport between the physics staff and the guidance-counseling staff, (10) to improve the image of 2-year college physics teachers, (11) to devote the major portion of instructor time and effort to courses for non-scientists, (12) to develop explicit objectives for physics courses and the necessity to make these objectives reasonable, and (13) to teach a relatively large number of different physics courses. (Author/TS)

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PHYSICS EDUCATION IN THE COMMUNITY COLLEGE*

Bernard E. Schrautemeier
Meramec Community College
St. Louis, Missouri 63122

As most of us are probably aware two relatively massive studies of physics education have been undertaken in the last year or two. One of these studies has been sponsored by the Commission on College Physics and dealt primarily with undergraduate physics education. The other study is being conducted under the auspices of the National Academy of Science and the National Research Council and is more general in character than the Commission on College Physics study. It is the purpose of this paper to summarize most of the inputs (and hopefully outputs) of these two studies as they relate to the community colleges.

Community colleges presently enroll approximately 50% of all undergraduate freshmen and sophomores. It is estimated that by 1980 approximately 60% of all undergraduate freshmen and sophomores will be in community colleges. Consequently, a substantial segment of all students enrolled in physics courses will be enrolled in physics courses in the community colleges. This means that there must be an active cooperation between the community colleges and the four-year colleges and universities. Each must consult the other and each must respect the other.

Since the comprehensive community college is a complex institution offering physics courses in the traditional subject matter areas as well as in the less familiar areas of technical and occupational education, remedial education, and adult education, the corresponding problems are complex. It is my purpose now to summarize these problems as well as to suggest solutions. Most of these problems relate to all aspects of the comprehensive community college physics program while a few of them zero in on specific segments of the physics programs such as the transfer courses, remedial courses, etc.

GENERAL ISSUES: SUCCESSES, PROBLEMS AND SUGGESTED SOLUTIONS:

1. THE NECESSITY TO TEACH COURSES IN FIELDS OTHER THAN PHYSICS.

A substantial minority of community college physics teachers also find themselves teaching other subjects such as chemistry, mathematics, geology, etc. In a relatively small community college the physics instructor is a "man for all seasons" and could be an unqualified physics instructor. These people need to receive additional training - perhaps in a fashion as has been done in previously held highly successful NSF summer institute

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but with some big changes over what has been done in the past. These institutes must be planned in large measure by successful, highly qualified community college physics instructors. The participants must be able to earn at least the equivalent of a full month's salary at these institutes - or else they won't come.

2. THE NECESSITY TO TEACH SEVERAL DIFFERENT LEVELS OF PHYSICS COURSES.

In the course of a typical week the average community college physics instructor will face a wide diversity of students, students ranging from the mathematically sophisticated college transfer type to the mathematically ignorant (and sometimes hostile) liberal arts type. He must be able to adapt his teaching styles and procedures to a wide variety of student abilities and interests.

To prepare a person to face such a wide spectrum of student abilities and to enable such a person to successfully cope with this spectrum, the colleges and universities preparing community college physics instructors must, in most cases, change their programs quite substantially. Above all, they must expose these prospective teachers to a wide variety of instructional methods. Much more emphasis upon non-traditional learning techniques must appear in the teacher training programs and in-service courses offered by the teacher training institutions. If at all possible prospective teachers should actually undergo the experience of taking such a non-traditional course from a neighboring successful community college teacher. Under the supervision of experienced community college instructors, teacher trainees should be required to develop non-traditional units of instruction - for example, audio-tutorial units, open laboratory experiments, mini courses, etc. An internship program at a neighboring community college would also be quite useful. Teacher training institutions must convince the prospective community college teacher that by choosing teaching as a career he has not made the second best choice and by choosing community college teaching as a goal he has not made a still worse choice.

3. THE NECESSITY TO DEAL WITH INCREASING NUMBERS OF STUDENTS WITH AVERAGE OR DEPRIVED EDUCATIONAL AND SOCIAL BACKGROUNDS.

The community college is essentially an open door college. Its student population in some instances differs radically from that of neighboring four-year schools and universities. Its student population is a microcosm of the community it serves. In many cases such a group of students cannot profit from the traditional types of physics courses. Traditional physics has very little to offer to many of these students. New courses and materials such as the recently developed Physical Science for Non-Science students course (PSNS) need to be developed. Physics

instructors must not fall into the trap of saying things like the following: "But I can't and won't water down my course! Physics is physics. It can't be changed". This approach is foolish and must be banished. We have to meet the students where they are, not where we would wish them to be.

4. THE NECESSITY TO REMAKE THE IMAGE OF PHYSICS.

As we all know, physics has a bad reputation. It is regarded by many students as being relatively impossible and perhaps even dangerous. Physics instructors at the community college level can and should make efforts to change these attitudes. Community college instructors must abandon the philosoply that dictates that all of their courses must be "rigorous". They must strive to design their courses to take as many of their students as possible as far as they can go. Students must be given every opportunity to be successful in physics. High failure rates must be eliminated. We must also convey to students that physicists are not amoral people. They must be shown to be like everyone else in that they do feel a sense of moral responsibility to try and better the lot of mankind. We must admit, however, that in many cases in the past scientists had dodged their moral responsibility and had retreated under the guise of "the search of knowledge for knowledge's sake". The aloofness and smugness so characteristic of many physics instructors in the past must be eliminated.

5. THE NECESSITY TO REFORMULATE THE BASIC GOALS OF PHYSICS EDUCATION AND TO TRY AND ORDER SUCH GOALS IN SOME SORT OF PRIORITY LISTING.

As we all know the honeymoon is over, research funding is leveling off if not actually declining, students are becoming more and more hostile towards science, etc. If physics is to survive it must now become much more strongly committed to educating its public. In many cases physics instructors in the community college must refuse to teach in the way that they were taught. They must strive to make their courses so attractive that they are oversubscribed rather than undersubscribed. Alienated students must be reached and brought back into the fold. New courses and new techniques are obviously needed. Educational technology must be employed to its utmost. The hierarchy in which research reigns supreme must be dismantled and one in which teaching and research jointly occupy the apex position must be substituted. Interdisciplinary approaches and courses must become the rule rather than the exception. Above all, our laity must be reached.

6. THE NECESSITY TO ADEQUATELY RESPOND TO THE GROWING DEMANDS OF THE ACCOUNTABILITY MOVEMENT.

Higher education is being required to justify in more and more detail its requests for funds. It is becoming harder and harder to justify equipment expenditures and small class loads for advanced courses.

Community college physics instructors must respond positively to such pressure from the public. New instructional techniques and the increased use of educational technology must be fully investigated as a means to hold down costs. More take home experiments need to be devised to cut laboratory costs. Perhaps the "luxury" of elementary laboratories with multiple stations needs to be abandoned in favor of more all purpose rooms with more efficient usuage patterns. Small advanced classes could probably be run using individualized instruction techniques. Course sequences within a given geographical region might be conducted in a somewhat staggered basis, resulting in the increased probability of equipment sharing. Expensive technical curricula should not be duplicated at all colleges in a given region. Cooperation must be the watchword. Defensive postures must be avoided. We must admit our mistakes but we should not be defensive about them. We should profit from them.

7. THE NECESSITY TO DEDICATE A DESIGNATED PERCENTAGE OF INSTITUTIONAL BUDGETS TO EDUCATIONAL RESEARCH AND IMPROVEMENT.

The community colleges are often referred to as "teaching institutions". They are this but if this is all that they are, then they are destined to fail and fail badly in future years. They must also be centers of educational research and development. Regularly appropriated funds must be available for such educationally oriented research. National funding agencies must also be willing to contribute substantial funds to such activities.

8. THE NECESSITY TO IMPROVE COMMUNICATION BETWEEN HIGH SCHOOL, 4-YEAR COLLEGE, UNIVERSITY AND COMMUNITY COLLEGE PHYSICS INSTRUCTORS.

In view of the crisis facing physics in education today it is vitally important that all aspects of the physics profession pull together. More effective channels of communications need to be set up. In most instances it is up to the colleges and universities to initiate these communication channels, if they do not already exist. They have the expertise to do so. However, they should merely act as coordinators and not as policy makers in such a venture. Above all, it must not appear that they are

attempting to dominate the community college and high school physics teachers through such communication channels. The professional associations - notably the AAPT - should also play a role in developing such a network.

9. THE NECESSITY TO MAINTAIN GOOD RAPPORT BETWEEN THE PHYSICS STAFF AND THE GUIDANCE-COUNSELING STAFF.

In many community colleges much course advisement and course placement is done by the guidance-counseling staff of the college. Unless care is exercised in these course advisement-enrollment interviews, students can be placed in courses for which they are not prepared or suited. Most guidance counselors do not have a wide background in science and science related topics and hence may be somewhat confused and possibly misinformed as to the real nature of the content of many physics courses. Efforts must be made to correct this situation if it exists at a particular community college. Ideally, specific guidance counselors should be identified as being associated with the science departments in the community colleges. Perhaps, these counselors should actually be quartered and supervised by the various science department-division heads.

10. THE NECESSITY TO IMPROVE THE IMAGE OF 2-YEAR COLLEGE PHYSICS TEACHERS.

The 2-year college is essentially a teaching institution. As such its "professors" are primarily teachers and not researchers. Unfortunately, in the eyes of some physics researchers, this makes the 2-year college physics instructor a second class citizen. This attitude must be modified. We cannot affort this type of infighting. The universities must merely stop giving lip service to the idea that teaching is important and put their money where their mouth is. Full professorship at the university must be just as attainable by a good university teacher as by a good university researcher. In this way the university will show that it really values teaching and the image of teaching in general will be enhanced. The community college administration must also act in the same way. Good instruction must be rewarded - and this means financially as well as editorially.

11. THE NECESSITY TO DEVOTE THE MAJOR PORTION OF INSTRUCTOR TIME AND EFFORT TO COURSES FOR NON-SCIENTISTS.

The community college physics instructor must realize that the majority of his load will probably entail the teaching of science courses to non-science students. Consequently, he needs to orient his thinking along these lines. He must attempt to adapt his teaching materials to the type of students he has. He must avoid the so-called "rigorous course content syndrome". Hopefully, by means of appropriate changes we can develop a reputation in colleges which will cause students to want to come to the science buildings and not merely to go there because they are required to do so. Once we get them to come willingly we will have won the war.

12. THE NECESSITY TO DEVELOP EXPLICIT OBJECTIVES FOR OUR PHYSICS COURSES AND THE NECESSITY TO MAKE THESE OBJECTIVES REASONABLE.

Community college physics instructors need to know what they intend to do before they attempt to do it. Specific course objectives - educational or performance objectives, if you will - need to be developed for all physics courses and programs. This will be relatively easy to do for the traditional college transfer courses but will be very hard to do for the courses for non-science majors and/or for the courses aimed at the adult population. An important part of this development should be a precise delineation of the constraints or limits under which the stated objectives are to be achieved. A realistic appraisal of our present situation should lead to a set of reasonable objectives which can be fulfilled by the vast majority of students at which our courses are aimed.

13. THE NECESSITY TO TEACH A RELATIVELY LARGE NUMBER OF DIFFERENT PHYSICS COURSES.

One of the missions of the community college is to articulate what the local 4-year institutions. Some of these local institutions may be quite large and complex and hence offer several types of introductory physics courses. Most community colleges, however, cannot offer such a large variety of introductory courses. A possible solution to this problem is to develop a sort of core course with many branches. These branches might be developed along self-paced instructional lines. All students would meet together for certain portions of the course but would branch into several independent tracks for certain other parts of the course. Also, since the other sciences might have the same types of problems perhaps some sort of interdisciplinary team teaching scheme would work. As it stands now many junior colleges cannot meet their stated objectives in physics education since they cannot offer the range of courses that the local transfer institutions demand.

CONCLUDING REMARKS:

The above listing covers most of the general problems facing physics education in the community college. There are, of course, many specific problems which relate to specific aspects of the physics course structures in the community colleges. These problems will just be mentioned in a very brief way.

Since a substantial number of community college students transfer to 4-year colleges and universities a very effective articulation program must exist between the community colleges and the local 4-year colleges and universities. Cooperation and mutual respect must be the byword here.

Physics courses for students in 2-year technical curricula is certainly one of the areas of physics instruction that has received scant attention until quite recently. A national effort (NSF-sponsored) is now underway to remedy this situation. Hopefully, these materials will help greatly.

The specific problems of physics education in the fields of general education, developmental education, and adult education are so closely interwoven with the general problems discussed above that they will not be pointed out again here.

In conclusion, physics education in the community colleges faces many problems, problems that are quite similar in many ways to the problems faced by physics education in the other parts of the higher education complex. These problems can be solved if - and only if - all segments of the physics community pull together and devote their energies to a mutually agreeable solution to these problems.